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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,509	11/25/2003	Ping-Kun Wu	67,200-1190	8941

7590 11/03/2005

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EXAMINER	
CHAMBLISS, ALONZO	
ART UNIT	**PAPER NUMBER**
2814	

DATE MAILED: 11/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/723,509	WU ET AL.	
	Examiner	Art Unit	
	Alonzo Chambliss	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 August 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29 and 42-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29 and 42-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The amendment filed on 8/17/05 has been fully considered and made of record in the instant application.

Response to Arguments

2. Applicant's arguments see remarks, filed 8/17/05, with respect to claims 1-29 have been fully considered and are persuasive. The non-final rejection of claims 1-29 has been withdrawn. A new non-final rejection is set forth below.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-29 and 42-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (US 6,342,448) in view of Chung et al. (US2003/0057526).

With respect to Claims 1, 10-13, 18, 23-25, 42, 43, 46, 47, and 52, Lin discloses providing a substrate comprising a semiconductor substrate 10 and forming an insulator layer (i.e. the combination of 48, 52 which is a low-K dielectric) on the substrate 10. Forming a damascene opening (i.e. the combination of 38,39) through a thickness portion of the insulator layer 48, 52. Forming a diffusion barrier layer 65 to line the damascene opening 38, 39 and forming a first seed layer 66 overlying the diffusion barrier 65. Planarizing the copper layer 68 form a metal interconnect structure (see col. 5 lines 25-67, col. 6 lines 1-10, col. 7 lines 30-54, col. 8 lines 1-67, col. 9 lines 1-39, and col. 10 lines 30-40; Figs. 1A-1D and 3A-3G). Lin fails to disclose plasma treating the first seed layer in-situ with a first plasma treatment comprising plasma source argon and nitrogen gas. Forming second seed layer overlying the first seed layer and forming a copper layer overlying the second seed layer according an electro-chemical plating (ECP) process to fill the damascene opening. Plasma treating the second seed layer with a second treatment plasma comprising an argon and nitrogen gas source. However, Chung discloses plasma treating the first seed layer 512 (i.e. made of copper) in-situ with a first plasma treatment comprising plasma source argon and nitrogen gas. Forming second seed layer 514 (i.e. made of copper) overlying the first seed layer 512 and forming a copper layer 516 overlying the second seed layer according an electro-chemical plating (ECP) process to fill the damascene opening. Plasma treating the second seed layer 514 with a second treatment plasma comprising an argon and

nitrogen gas source (see paragraphs 37, 49-53, 59-65; Figs. 4 and 5A-5C). Thus, Lin and Chung have substantially the same environment of a damascene opening covered with a barrier layer and a seed layer on top of the barrier layer. Therefore, one skilled in the art at the time of the invention would readily recognize incorporating a second seed layer by plasma sources gases on the first seed layer of Lin, since the second seed layer would improved the interconnect structure and method of deposition of the interconnect structures as taught by Chung.

With respect to Claims 2 and 3, Chung discloses wherein the first and second seed layers form a continuous layer over active areas of the substrate (see Figs. 5A-5C).

With respect to Claims 4 and 5, Chung discloses wherein one of the first and second seed layers is substantially conformally deposited on the top surface of the insulating layer (see Figs. 5A-5C). One skilled in the art would readily recognize having a nonconformally first or second layer in the damascene opening, since the nonconformally first layer would exist at some level of deposition of the material which would be improved by the deposition of the second seed layer.

With respect to Claims 6 and 19, Lin discloses wherein the first seed layer is deposited according to a deposition process of CVD process (see col. 9 lines 1-25).

With respect to Claims 7-9 and 20-22, Chung discloses wherein the first and second seed layers are deposited according to a PVD or CVD process (see paragraphs 49 and 50).

With respect to Claims 14, 26, and 48, Lin discloses wherein the insulator layer comprises a low-K dielectric insulator having a dielectric constant of less than about 3.0 (i.e. 2.6 to 2.8) (see col. 2 lines 25-33 and col. 4 lines 15-23).

With respect to Claims 15, 16, 27, 28, 49, and 50, Chung wherein the first seed layer and second layer have a combined thickness of is formed having a thickness of about 50 Angstroms to about 300 Angstroms (see paragraph 64). Thus, for example when the first seed layer is 100 Angstroms and the second seed layer is 200 Angstroms.

With respect to Claims 17 and 29, Lin discloses wherein the diffusion barrier layer comprises a material TaN (see col. 8 lines 38-42).

With respect to Claims 44 and 45, Lin discloses wherein the insulator layer comprises a porous low-K dielectric insulator (see col. 2 lines 19-33).

With respect to Claim 51, Chung discloses plasma treatment of the first and second layers, which would yield the first, and second seed layers that are substantially oxide free prior to deposition of the copper layer.

The prior art made of record and not relied upon is cited primarily to show the process of the instant invention.

Conclusion

5. Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (571) 272-1927.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system see http://pair-dkect.uspto.gov. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free) or EBC_Support@uspto.gov.

AC/October 30, 2005

Alonzo Chambliss
Primary Patent Examiner
Art Unit 2814